

REMARKS

Please reconsider the application in view of the above amendments and the following remarks. Applicant thanks the Examiner for carefully considering this application and indicating that claims 1-51 contain allowable subject matter.

I. Disposition of Claims

Claims 1-52 are pending in this application. Claim 52 is independent. The remaining claims depend, directly or indirectly, from claim 52. Claim 52 has been amended in this reply. No new matter has been added by way of these amendments.

II. Rejection(s) under 35 U.S.C § 102

Claim 52 was rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,181,668 ("Kajiyama"). The remaining claims have been objected to for being dependent on a rejected base claim. Claim 52 has been amended in this reply to clarify the present invention recited. To the extent that this rejection may still apply to the amended claims, the rejection is respectfully traversed.

The Present Invention

As recited in claim 52, the present invention relates to an optical head that includes at least one light source, a photodetector, and at least one diffractive optical element. The light source emits beams that have a plurality of wavelengths. The diffractive optical element is provided in an optical path common to the beams having the plurality of wavelengths. Additionally, a first diffraction light and a second diffraction light that are emitted from the diffractive optical element are substantially different in

diffraction order with respect to the beams having a plurality of wavelengths.

Further, the diffraction orders of the first diffraction light and the second diffraction light are not of the zeroth order and the diffraction order of the diffraction light with a longer wavelength is smaller than the diffraction order of the diffraction light with a shorter wavelength.

For example, a first order of the diffraction light with a 0.78 μm wavelength and a second order of the diffraction light with a 0.635 μm wavelength is an example of a diffraction order with a longer wavelength being smaller than the diffraction of the diffraction light with a shorter wavelength.

Typically, when using diffractive elements in optical heads (instead of refractive elements), the optical head can be reduced in size, thickness and weight. Additionally, diffractive elements can produce practically 100% diffraction efficiency with respect to a particular design wavelength. However, the diffraction efficiency decreases gradually as the wavelength deviates from the design value. With the emergence of various optical disks (CD, DVD, *etc.*), a plurality of wavelengths is required for reading the various information recording media. Therefore, when mounting various optical disks, a diffractive optical element must be designed for each wavelength and positioned only in the optical path of the beam having a wavelength for which it was intended, in order to maintain diffraction efficiency.

The present invention advantageously provides an optical head having at least one diffractive element with increased diffraction efficiency for reading various types of information recording media. In other words, in one or more embodiments of the present invention, various wavelengths may be used, while maintaining the diffraction efficiency.

Moreover, the instant specification discusses that, assuming the first wavelength is substantially longer than the second wavelength, high diffraction efficiency may be obtained for both the first wavelength and the second wavelength, even when placing the diffractive optical element in an optical path common to a first wavelength and a second wavelength. This is achieved by using a substantially second-order diffraction light out of lights diffracted by the diffractive optical element when emitting the beam with the first wavelength and by using a substantially first-order diffraction light out of lights diffracted by the diffractive optical element when emitting the beam with the second wavelength. (Please see instant specification p. 18 and Figure 2.)

Kajiyama

Kajiyama fails to teach all of the elements of the present invention as recited in amended claim 52. Contrary to the present invention, Kajiyama only discloses the situation in which a shorter wavelength is used in conjunction with a smaller diffraction order. The attached exhibit shows three calculated diffraction efficiencies of Kajiyama with respect to three types of holograms with typical shapes, *i.e.*, a blazed hologram and two step-like holograms (which are specifically disclosed by Kajiyama). As noted in the attached exhibit, the blaze hologram achieves the highest diffraction efficiencies. However, even in the blazed hologram, a first-order diffraction efficiency for a beam with a wavelength of 0.635 μm and a second-order diffraction efficiency for a beam with a wavelength of 0.78 μm only achieves 20% diffraction efficiency (*i.e.*, the point where the curves intersect). A diffraction efficiency of a mere 20% does not have sufficient industrial utility. In view of the findings of the present invention, such low diffraction efficiencies are a result of the diffraction order of the beam with the shorter wavelength

being smaller than the diffraction order of the beam with the longer wavelength.

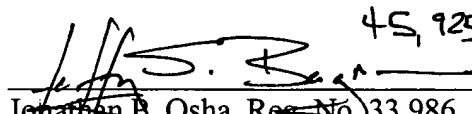
Claim 52, as amended, requires that the “the diffraction order of the diffraction light with a longer wavelength is smaller than the diffraction order of the diffraction light with a shorter wavelength.” Because Kajiyama only discloses a diffraction order of the beam with the shorter wavelength being smaller than the diffraction order of the beam with the longer wavelength, Kajiyama does not disclose the present invention as recited in amended claim 52. Moreover, such a limitation is not suggested by Kajiyama. Therefore, claim 52 is patentable over Kajiyama. Claims 1-51, being dependent on claim 52, are patentable for at least the reasons set forth above. Accordingly, withdrawal of the §102 rejection is respectfully requested.

III. Conclusion

The above amendments and remarks are believed to require no further prior art search. Also, Applicant believes that this reply is responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Because the amendments and remarks simplify the issues for allowance or appeal, and do not constitute new matter, entry and consideration thereof is respectfully requested. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 04558/036001).

Date: 8/4/04

Respectfully submitted,

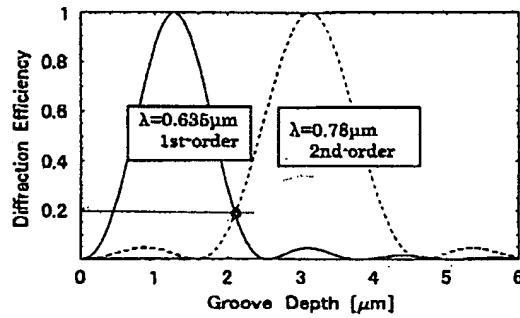

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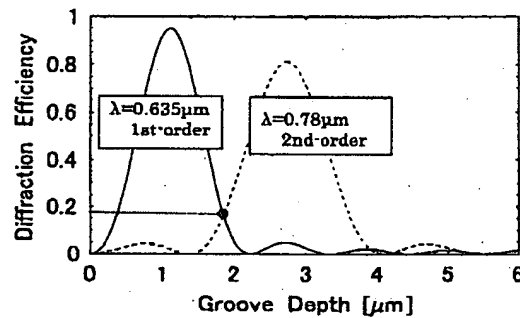
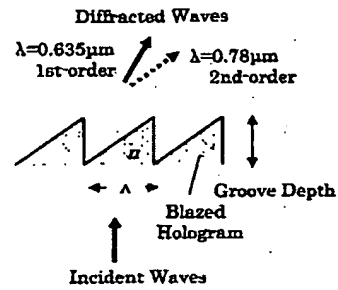
Exhibit

Diffraction Efficiency of Kajiya et al.

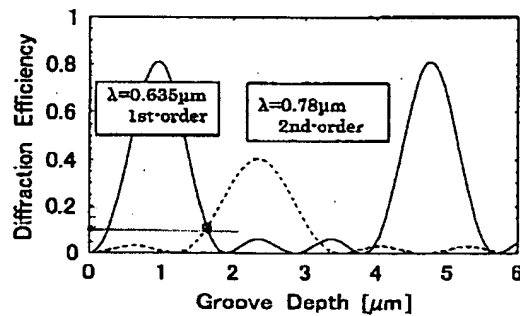
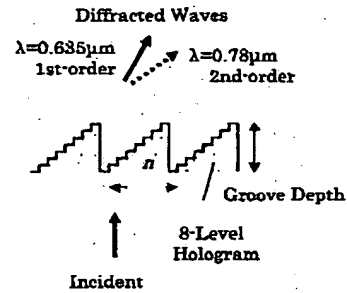
(when the period is sufficiently larger than the wavelength)



(a) Blazed Hologram



(b) 8-Level Hologram



(c) 4-Level Hologram

